

4.1.20

$$A = \begin{bmatrix} 5 & -2 & 3 \\ 4 & 1 & 5 \\ 3 & 3 & 2 \end{bmatrix}, \quad x = \begin{bmatrix} -1 \\ 3 \\ 2 \end{bmatrix}$$

a.) Matrix Multiplication

$$\begin{bmatrix} 5 & -2 & 3 \\ 4 & 1 & 5 \\ 3 & 3 & 2 \end{bmatrix} * \begin{bmatrix} -1 \\ 3 \\ 2 \end{bmatrix}$$

$$\underbrace{3 \times 3 \cdot 3 \times 1}_{= 3 \times 1}$$

$$5(-1) + (-2)(3) + 3(2) = -5$$

$$4(-1) + 1(3) + 5(2) = 9$$

$$3(-1) + 3(3) + 2(2) = 10$$

$$Ax = \begin{bmatrix} -5 \\ 9 \\ 10 \end{bmatrix}$$

b.) Column Expansion

$$-1 \begin{bmatrix} 5 \\ 4 \\ 3 \end{bmatrix} + 3 \begin{bmatrix} -2 \\ 1 \\ 3 \end{bmatrix} + 2 \begin{bmatrix} 3 \\ 5 \\ 2 \end{bmatrix} = \begin{bmatrix} -5 \\ -4 \\ -3 \end{bmatrix} + \begin{bmatrix} -6 \\ 3 \\ 9 \end{bmatrix} + \begin{bmatrix} 6 \\ 10 \\ 4 \end{bmatrix} = \begin{bmatrix} -5 \\ 9 \\ 10 \end{bmatrix}$$

$$Ax = \begin{bmatrix} -5 \\ 9 \\ 10 \end{bmatrix}$$

4.1.59

$$A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 1 & -1 \\ -1 & 0 \end{bmatrix}$$

a.) Innerproduct

$$\langle A, B \rangle = (1)(1) + (1)(-1) + (0)(-1) + (1)(0) = 0$$

$$\langle A, B \rangle = 0$$

b.) Orthogonality

Since $\langle A, B \rangle = 0$, A & B \therefore are orthogonal